What is claimed is:

1. A method for assaying an analyte, which method comprises:

a) providing a reactant capable of binding and/or reacting with an analyte to be analyzed on an oxide electrode;

b) contacting a sample suspected of containing said analyte with said reactant provided in step a) under suitable conditions to allow binding of said analyte, if present in said sample, to said reactant, wherein said reactant, said analyte, or additional reactant or additional analyte or analyte analog is covalently linked to an electrochemically active molecule in a reduced form, and said contacting brings said electrochemically active molecule into close proximity to said electrode to allow oxidation of said electrochemically active molecule by said electrode;

c) allowing reduction of said oxidized electrochemically active molecule back to said reduced form by a reducing agent, wherein said reducing agent is not capable of being oxidized directly by said electrode, and said reduced electrochemically active molecule participates in said oxidation-reduction reactions of steps b) and c) repeatedly to generate an amplified electrochemical signal; and

d) assessing said amplified electrochemical signal to determine presence and/or amount of said analyte in said sample.

2. The method of claim 1, wherein the analyte is selected from the group consisting of a cell, a cellular organelle, a virus, a molecule and an aggregate or complex thereof.

3. The method of claim 2, wherein the cell is selected from the group consisting of an animal cell, a plant cell, a fungus cell, a bacterium cell, a recombinant cell and a cultured cell.

4. The method of claim 2, wherein the cellular organelle is selected from the group consisting of a nuclei, a mitochondrion, a chloroplast, a ribosome, an ER, a Golgi apparatus, a lysosome, a proteasome, a secretory vesicle, a vacuole and a microsome.

5. The method of claim 2, wherein the molecule is selected from the group consisting of an inorganic molecule, an organic molecule and a complex thereof.

6. The method of claim 5, wherein the organic molecule is selected from the group consisting of an amino acid, a peptide, a protein, a nucleoside, a nucleotide, an oligonucleotide, a nucleic acid, a vitamin, a monosaccharide, an oligosaccharide, a carbohydrate, a lipid and a complex thereof.

7. The method of claim 1, wherein the analyte is selected from the group consisting of a hormone, a cancer marker, a steroid, a sterol, a pharmaceutical compound, a metabolite of a pharmaceutical compound and a complex thereof.

8. The method of claim 1, wherein the sample is a mammalian sample.

9. The method of claim 8, wherein the mammal is selected from the group consisting of bovine, goat, sheep, equine, rabbit, guinea pig, murine, human, feline, monkey, dog and porcine.

10. The method of claim 1, wherein the sample is a clinical sample.

11. The method of claim 10, wherein the clinical sample is selected from the group consisting of serum, plasma, whole blood, sputum, cerebral spinal fluid, amniotic fluid, urine, gastrointestinal contents, hair, saliva, sweat, gum scrapings and tissue from biopsies.

12. The method of claim 10, wherein the clinical sample is a human clinical sample.

13. The method of claim 1, wherein the sample is a body fluid sample.

14. The method of claim 1, wherein the reactant binds and/or reacts specifically with the analyte.

15. The method of claim 1, wherein the reactant is selected from the group consisting of a cell, a cellular organelle, a virus, a molecule and an aggregate or complex thereof.

16. The method of claim 1, wherein the reactant is an antibody.

17. The method of claim 1, wherein the reactant is a nucleic acid.

18. The method of claim 1, which is used in a direct assay format wherein the analyte is covalently linked to an electrochemically active molecule and the contact between the reactant on the electrode with the analyte brings the electrochemically active molecule into close proximity to the electrode.

19. The method of claim 1, which is used in a sandwich assay format wherein the reactant on the electrode, the analyte and a second reactant capable of binding and/or reacting with the analyte and covalently linked to an electrochemically active molecule forms a sandwich and brings the electrochemically active molecule into close proximity to the electrode.

20. The method of claim 1, which is used in a competition assay format wherein the analyte and an analyte or analyte analog with a covalently linked electrochemically active molecule competes for the binding with the reactant on the electrode and the binding of the analyte or analyte analog with the covalently linked electrochemically active molecule with the reactant brings the electrochemically active molecule into close proximity to the electrode.

21. The method of claim 1, wherein the electrochemically active molecule is a transition metal complex.

22. The method of claim 21, wherein the transition metal complex is selected from the group consisting of a ferrocene, a metal porphyrin, a metal polypyridine, a metal poly-phenanthroline and a metal phthalocyanine.

23. The method of claim 21, wherein the transition metal is selected from the group consisting of cobalt, nickle, osmium, iron, rehnium, chromium and ruthenium.

24. The method of claim 21, wherein the transition metal complex is a metal tris(2,2'-bipyridine) or one of its derivatives.

25. The method of claim 21, wherein the transition metal complex is ruthenium tris(2,2'-bipyridine) or one of its derivatives.

26. The method of claim 1, wherein the oxide electrode is native or formed *in situ*.

27. The method of claim 26, wherein the electrode is selected from the group consisting of gold, platinum, silver, cobalt, nickel and carbon electrode.

28. The method of claim 1, wherein the electrode is a metal oxide electrode.

29. The method of claim 28, wherein the electrode is a single metal oxide or a combination of two or more metal oxides.

30. The method of claim 28, wherein the metal oxide is selected from the group consisting of indium oxide, tin oxide, titanium oxide, zirconium oxide, tungsten oxide, zinc oxide and iron oxide.

31. The method of claim 28, wherein the metal oxide is a pure metal oxide or a doped metal oxide.

32. The method of claim 31, wherein the doped metal oxide is a tin-doped indium oxide.

33. The method of claim 31, wherein the doped metal oxide is a florine-doped tin oxide.

34. The method of claim 1, wherein the reducing agent is soluble in an aqueous solution.

35. The method of claim 1, wherein the reducing agent is an organic redox molecule.

36. The method of claim 35, wherein the organic redox molecule is selected from the group consisting of an organic acid, an organic base, an organic ion and an organic zwitterion.

37. The method of claim 36, wherein the organic acid is a carboxylic acid

38. The method of claim 36, wherein the organic acid is oxalic acid.

39. The method of claim 36, wherein the organic base is an amine.

40. The method of claim 36, wherein the organic base is a primary, a secondary, or a tertiary amine.

41. The method of claim 36, wherein the organic base is tripropyl amine.

42. The method of claim 35, wherein the organic redox molecule is an ionized organic acid or an ionized organic base.

43. The method of claim 42, wherein the ionized organic acid is oxalate.

44. The method of claim 42, wherein the ionized organic base is protonated tripropyl amine.

45. The method of claim 36, wherein the organic zwitterion comprises an organic base and an organic acid.

46. The method of claim 45, wherein the organic base is an amine and the organic acid is a carboxylic acid.

47. The method of claim 45, wherein the organic base is an amine and the organic acid is a sulfonic acid.

48. The method of claim 36, wherein the organic zwitterion is an amino acid.

49. The method of claim 48, wherein the amino acid is proline.

50. The method of claim 36, wherein the organic zwitterion is a "Good" buffer.

51. The method of claim 50, wherein the "Good" buffer is selected from the group consisting of BES, BICINE, CAPS, HEPPS, HEPES, MES, MOPS, PIPES, TAPS, TES and TRICINE.

52. The method of claim 1, which is used in an assay format selected from the group consisting of an enzyme-linked immunosorbent assay (ELISA), immunoblotting, immunoprecipitation, radioimmunoassay (RIA), immunostaining, latex agglutination, indirect hemagglutination assay (IHA), complement fixation, indirect immunofluorescent assay (IFA), nephelometry, flow cytometry assay, chemiluminescence assay, lateral flow immunoassay, μ-capture assay, inhibition assay, energy transfer assay, avidity assay, turbidometric immunoassay and time resolved amplified cryptate emission (TRACE) assay.

53. A kit for assaying an analyte, which kit comprises:

a) a reactant capable of binding and/or reacting with an analyte to be analyzed on an oxide electrode;

b) an additional reactant, analyte, or analyte analog that is covalently linked to an electrochemically active molecule in a reduced form, wherein contacting of said analyte with said reactant on said electrode in the presence of said additional reactant,

analyte, or analyte analog that is covalently linked to said electrochemically active molecule brings said electrochemically active molecule into close proximity to said electrode to allow oxidation of said electrochemically active molecule by said electrode;

c) a reducing agent, wherein said reducing agent is not capable of being oxidized directly by said electrode, and said reducing agent reduces said oxidized electrochemically active molecule back to said reduced form to participate in repeated oxidation-reduction reactions to generate an amplified electrochemical signal; and

d) means for assessing said amplified electrochemical signal to determine presence and/or amount of said analyte in said sample.

54. The kit of claim 53, which further comprises an instruction for using the kit to assay the analyte.

55. The kit of claim 53, which further comprises an oxide electrode that is capable of oxidzing the electrochemically active molecule but is not capable of oxidzing the reducing agent.